REMARKS

This Amendment and Response is submitted in response to the Office Action mailed 12 August 2004 and includes a Petition for a One-Month Extension of Time to extend the due date to Monday, 13 December 2004.

Claim Status

Claims 1-3, 5, 7-20, and 25-57 are pending after entry of the present amendment. Of these, claims 34-40 are withdrawn herein as being directed to a non-elected invention, and claims 42-57 are newly added here. A complete listing of all claims that are, or were in the application, along with an appropriate status identifier, is provided above in the section entitled "Amendments to the Claims".

Summary of the Claims Rejections

The Examiner has rejected claim 8 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The examiner also noted that claim 8 depends on claim 9.

The Examiner has rejected claims under 35 U.S.C. 102(b) as follows: claims 1-3, 5, 7-12, 32, 33, and 41 as being anticipated by Japan 10-217108; claims 1-3, 5, 7-13, 32, 33, and 41 as being anticipated by Japan 11-333712; and claims 1-3, 5, 7-12, 14, 32, 33, and 41 as being anticipated by Glashauser (US 6419567).

With respect to the 35 U.S.C. 102(b) rejections, the Examiner suggests that Japan '108, Japan '712, and Glashauser '567 discloses a retaining ring of a subcarrier for holding a wafer during polishing having certain features and concludes without further rational or justification that the distance of the groove from the edge and the depth and width based on magnitude of a force is incidental.

The Examiner has also rejected claims under 35 U.S.C. 103 as follows: claims 1-3, 5, 7-12, 15-20, 29-33, and 41 as being unpatentable over Japan 10-217108 alone; claims 1-3, 5, 7-13, 15-20, 25, 26, 29-33, and 41 as being unpatentable over Japan 11-333712 alone; and claims 1-3, 5, 7-12, 14-20, 27-33, and 41 as being unpatentable over Glashauser (US 6419567) alone.

With respect to the 35 U.S.C. 103 rejections, the Examiner suggests that Japan '108, Japan '712, and Glashauser '567 discloses a retaining ring of a subcarrier for holding a wafer during polishing having certain features and concludes without further rational or justification that the distance of the groove from the edge and the depth and width based on magnitude of a force is incidental and a matter of obvious design choice. The Examiner further suggests that the selection of materials for the retaining ring would have been an obvious design expedient dependent on machining parameters.

Response to the Claims Rejections

Applicant respectfully disagrees with the suggestion that the suggestions that the distance of the groove from the edge and the depth and width based on magnitude of a force is incidental or a matter of obvious design choice, and that the selection of materials for the retaining ring would have been an obvious design expedient dependent on machining parameters. While a designer might be forced to make certain design choices in order to make a physical retaining ring structure for use in a polishing machine, the designer is not likely to make design choices that would result in a retaining ring that would result in the desired polishing properties for particular combinations of polishing pad characteristics, retaining ring force, subcarrier force, polishing pad material and rebound characteristics, substrate (semiconductor wafer) size, and other factors. Even if the designer were to make a design choice based on machining parameters, the designer would most likely retain these same parameters for all retaining ring designs unless the designer appreciated that, for example, the distance of the recess or groove from the edge and the depth and width of the recess or groove should be chosen based on magnitude of a force as required in the claims before the amendments presented herein.

None of the cited art in anyway discloses, suggests, or motivates any need for a polishing head, polishing apparatus, or polishing method as recited in the claims. While applicant submits that the claims were patentably distinguished from the cited art prior to the amendments presented herein, in the interest of more rapidly progressing prosecution of the claims toward allowance, Applicant has amended the claims to further and more clearly distinguish aspects of the invention.

With reference to claim 1 as amended herein and set forth below for ready reference, the claimed invention now introduces features of the polishing pad into the preamble of the claim that provides an environment in which the claimed polishing head operates. While these polishing pad features are not per se elements of the claim, they provide an antecedent basis for elements of the retaining ring elements that are recited.

> 1. A polishing head for polishing a surface of a substrate against a polishing pad surface to achieve an even removal of material near the substrate surface edge and interior to the substrate surface, *the polishing pad surface having a hardness and undergoing a deformation when a pressure force is applied and having at least a partial rebound from the deformation in a first time period after a portion of the pressure force is removed and having a full rebound in a second time period after all the pressure force is removed, the polishing pad being viscoelastic so that it exhibits different elastic properties to force applied in different directions or for different lengths of times and having a thickness that changes over time,* the polishing head comprising:

a carrier;

a subcarrier carried by the carrier and adapted to hold the substrate during a polishing operation; and

a retaining ring having an inner edge disposed about the subcarrier and a lower surface in contact with the polishing surface during the polishing operation, the lower surface of the retaining ring having *at least one recess disposed along a substantially annular path on the lower surface of the retaining ring and sized in width and depth so that the polishing pad surface adjacent the recess at any moment during polishing partially rebounds an amount of the polishing pad into the recess so that the polishing pad surface fully rebounds in a shorter time and in a shorter distance after moving under the substrate across the inner edge of the retaining ring, the force on the substrate in an area near the outer edge of the substrate being thereby adjusted to achieve a predetermined polishing effect where the amount of material removed from the substrate surface edge is substantially the same as the amount of material removed interior to the substrate surface edge, the at least one recess positioned a predetermined distance from the inner edge of the retaining ring selected based on a magnitude of a first force applied to the retaining ring during the polishing operation, a magnitude of a second force applied to the subcarrier during the polishing operation, or both.*

The retaining ring is now required to have "*at least one recess disposed along a substantially annular path on the lower surface of the retaining ring*". The requirement that the recess be an annular recess removed to dependent claim 42 so that embodiments of the invention that have a plurality of recesses and/or different shapes of recesses are covered as indicated in several of the dependent claims.

Claim 1 also now requires that the recess is "*sized in width and depth so that the polishing pad surface adjacent the recess at any moment during polishing partially rebounds an amount of the polishing pad into the recess so that the polishing pad surface fully rebounds in a shorter time and in a shorter distance after moving under the substrate across the inner edge of the retaining ring*". None of the cited references disclose, suggest, or motivate any need for sizing the width and depth to achieve this partial rebound characteristic.

Claim 1 also now requires that "*the force on the substrate in an area near the outer edge of the substrate being thereby adjusted to achieve a predetermined polishing effect where the amount of material removed from the substrate surface edge is substantially the same as the amount of material removed interior to the substrate surface edge, the at least one recess positioned a predetermined distance from the inner edge of the retaining ring selected based on a magnitude of a first force applied to*

the retaining ring during the polishing operation, a magnitude of a second force applied to the subcarrier during the polishing operation, or both."

Again, Applicant respectfully submits that none of the cited references disclose, suggest, or motivate any need for these characteristics alone or in combination with the other elements of the claimed invention. The cited prior art evidences no appreciation for the manner in which a suitably sized and positioned recess, such as an annular groove, impacts the material removal effect; and how the material removal effect may be modified so that the amount of material removed proximate the edge of a substrate may be controlled so that it is the same or substantially the same as for the remainder of the substrate interior to the edge.

The dependent claims recite additional features that further distinguish the invention from the cited art. For example, with reference to claim 3, the cited art fails to disclose or suggest that the "at least one annular recess is adapted to reduce a length of time during which the polishing surface is deformed by the retaining as the retaining ring is moved relative to the polishing surface." With reference to claim 5, the cited art fails to disclose or suggest that the "at least one annular recess is positioned a predetermined distance from the inner edge of the retaining ring, the predetermined distance selected to reduce the area near the edge of the substrate having a lower polishing rate than a center of the substrate due to rebounding of the pad." With reference to claim 7, the cited art fails to disclose or suggest that the "predetermined distance is selected based on a hardness of the polishing surface." With reference to claim 8, the cited art fails to disclose or suggest that the "predetermined depth and the predetermined radial width are selected to reduce the area near the edge of the substrate having a lower polishing rate than a center of the substrate due to rebounding of the polishing surface." With reference to claim 13, the cited art fails to disclose or suggest that the "at least one annular recess comprises a plurality of concentric grooves" in combination with the other elements. With reference to claim 14, the cited art fails to disclose or suggest "a chemical dispensing mechanism adapted to dispense chemical onto the polishing surface during the polishing operation; and a drive mechanism adapted to move the polishing head relative to the polishing surface during the polishing operation." Newly added claims 4257 are dependent from claim 1 directly or via an intervening claim and recite additional features not disclosed or suggested in the prior art.

Claims 9, 11, 15, 30, and 32 are independent claims including independent apparatus and method claims. Applicant has amended these claims in a manner analogous to the amendments made for claim 1, though the claim amendments are not identical. Each of these amended claims not recite structural, functional, and/or methodological features of the retaining ring and its interaction with the substrate and/or polishing surface or pad. Rather than repeat each claim element and remark separately for these claims, Applicant respectfully requests the examiner review the claim amendments that are presented and the remarks made relative to claim 1 and its dependent claims above. Applicant has not

amended claim 8 and submits that any indefiniteness that may have been present has now been resolved by the amendments to its base claim 9.

Applicant submits that each of the claims now presented is patentably distinguished over the cited prior art and requests withdrawal of the 35 U.S.C. 102(b) and 35 U.S.C. 103 rejections and allowance of each claim.

CONCLUSION

If after review, the Examiner feels there are further unresolved issues, the Examiner is invited to call the undersigned at (650) 494-8700.

Respectfully submitted,
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